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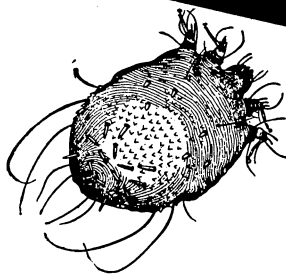
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HOG LICE and HOG MANGE

Methods of Control and Eradication

**FARMERS'
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UNITED STATES DEPARTMENT OF AGRICULTURE

LICE and mange mites are the principal external parasites that affect hogs. They are injurious to all classes of hogs, but are particularly harmful to pigs and poorly nourished hogs kept in insanitary quarters.

The losses they cause are due to irritation, unthrifty condition, functional disturbances, arrested growth, low vitality, and increased death rate.

Only one species of lice commonly affects hogs. This parasite obtains its food by puncturing the skin of the host and sucking blood. It can be eradicated by hand applications, spraying, medicated wallows, and dipping. Dipping is the best method of applying most of the insecticides. The old remedies, such as crude petroleum and coal-tar-creosote and lime-sulphur dips, while still effective, are being replaced by the more effective chlorinated hydrocarbon insecticides. The most commonly used are DDT, BHC, lindane, chlordane, toxaphene, and methoxychlor. The results achieved with two or more treatments at 14- to 16-day intervals with the old dips are now being obtained by a single treatment with new insecticides. Rotenone and pyrethrum, insecticides of plant origin, are also being used.

Two species of mange mites commonly affect hogs. As with lice, old remedies are being replaced by chlorinated hydrocarbons. A single treatment for common (sarcoptic) mange with some of the chlorinated hydrocarbon insecticides is as effective as two dippings with remedies formerly used.

The nature and habits of these parasites, symptoms caused by each species, and methods of control and eradication are discussed in this bulletin. Plans for hog wallows and dipping plants, with directions for building them, are also given.

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Cover illustration:

Top, hog louse. Bottom, sarcoptic mange mite.

Hog Lice and Hog Mange

Methods of Control and Eradication

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Hog Lice

Distribution and Economic Importance

HOG LICE infest both domesticated and wild hogs in practically all parts of the world, including all areas of the United States where hogs are raised. Livestock growers generally recognize them as a pest responsible for considerable losses to the swine industry.

In obtaining their food the lice puncture the skin of the host animal and suck blood and lymph. The skin is punctured every time a louse feeds. A single puncture causes irritation and itching, and as each louse feeds at frequent intervals, the irritation and itching are almost constant in gross infestations. In an attempt to relieve the intense itching the infested animals scratch themselves with their feet and rub violently against any convenient object. The frequent rubbing destroys the hair in patches

and often wounds the skin. The lice congregate around the abrasions and thus cause further irritation.

Lice may attack hogs of any age or condition; if the pest is allowed to spread, the infested animals suffer and the owner loses in the increased quantity of feed consumed per pound of gain, arrested growth of young pigs, and shrinkage in weight of fattening hogs. When lice from the brood sow infest young pigs and are allowed to remain until the hogs are ready for butchering, the losses they cause run up the cost of producing pork. Estimates based on observations and limited experimental data fix the direct money loss in such cases at from 2 to 6 percent of the market value of the hog.

The indirect losses due to lice are seldom taken into consideration, because on casual observation they are less apparent. Hogs infested by large numbers of lice suffer a lowering of vitality and a generally unthrifty condition which makes them

¹ Revision of former editions by Dr. Marion Imes.

more susceptible to attack by other parasites and by contagious diseases. The damage and losses caused by hog lice are important enough to warrant treatment for their eradication.

Nature and Habits

The hog louse, *Haematopinus ad-venticius* var. *chinensis* (*H. suis*), a bloodsucking parasite, is the largest of the lice affecting domestic animals. The full-grown female often attains a length of one-fourth of an inch. The male louse is slightly smaller and can be distinguished by a black streak on the underside of the abdomen along the middle of the last three segments. The feet are adapted for clasping the hairs, and the lice travel sideways through the hair or bristles of the hog.

The entire life cycle is passed on the host. The females deposit and glue their eggs, or nits, on the hairs close to the skin. They may occur on any part of the body, but they prefer the lower half of the sides, around the neck, shoulders, and flanks. The female lays from 3 to 6 eggs a day and the average length of the egg-laying period is 25 days. She averages 90 eggs during her lifetime. The eggs hatch on the



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FIGURE 1.—Male hog louse.



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FIGURE 2.—Female hog louse and egg attached to hair.

host in from 12 to 20 days, most of them in from 12 to 14 days. The young lice become active soon after hatching and seek the parts covered by tender skin for feeding. Their favorite spot, especially during cold weather, is inside the ear, where they often congregate in large clusters. Here the skin is tender, and they are protected from the cold and also from the efforts of the host to dislodge them. When it finds a suitable place, the young louse punctures the skin with its sharp mouth parts and sucks blood until satisfied.

Hog lice do not remain attached to the skin like ticks, but detach after each feeding and, singly or in groups, wander about through the hair or remain quiet. They feed at frequent intervals and develop rapidly. Lice reach maturity and start mating when they are about 10 days old. The females begin laying eggs when they are about 12 days old; the average life span is 35 days.

As a rule, hog lice infest hogs only. They do not voluntarily leave their natural host; when separated from it they live only 2 or 3 days. The lice pass readily from

one hog to another when the animals come in close contact. Practically all infestations result from contact with lousy animals, not from infested premises. Under reasonably good sanitary conditions pens, corrals, and premises which have held lousy hogs are not a source of danger to hogs free from lice. As a precautionary measure, however, and because it is good sanitary practice, all small enclosures in which lousy hogs have been kept should be cleaned and disinfected before being used for a new lot of hogs. The litter and manure should be removed and the floors cleaned, after which the woodwork and floors should be sprayed with a good disinfectant. The coal-tar-cresote dips, diluted in accordance with instructions on the containers, are suitable.

Hog Mange

Varieties and General Characteristics

Mange in hogs is a scabies, or itch, caused by mites, insectlike parasites that live in the skin. The two species responsible for it belong to the genera *Sarcoptes* and *Demodex*. The sarcoptic mites cause sarcoptic mange, which is the more common form. The demodectic mites cause demodectic, or follicular, mange.

Mange mites spend their entire lives on the host animal. In taking food from the tissues and blood of the host they cause wounds or lesions in the skin. As each kind of mite has distinctive habits in its feeding and other activities, its lesions are characteristic. Sarcoptic mites burrow into the skin. Each female makes a separate gallery in which she lays her eggs. The skin over and around the burrow or gallery becomes irritated and inflamed, with a small cone-shaped swelling. The demodectic mites are very small, looking somewhat like micro-

scopic worms. They live in colonies or groups in the hair follicles and oil glands, producing small, spherical, hard swellings.

Sarcoptic (Common) Mange

Sarcoptic mange occurs in hogs in the United States much more frequently than the follicular variety. The Corn Belt has the greatest amount of sarcoptic mange, but there is some even in the West where comparatively small numbers of hogs are raised. In some parts of the Corn Belt, where systematic treatment with chlorinated hydrocarbon insecticides has been practiced for 3 or 4 years, a noticeable decline in the incidence of hog mange was observed during 1951. In other areas, where treatment was neglected, the incidence of mange increased.

Traffic in breeding stock plays an important part in spreading the disease among hogs. Like scab in other animals, it spreads rapidly under favorable conditions unless active control measures are taken. Although pigs, young growing stock, and poorly nourished old animals of low vitality suffer most from its ravages, sarcoptic mange often attacks vigorous mature hogs. The losses from this mange are due to irritation, arrested growth, unthrifty condition, lowered vitality, functional disorders, and high death rate. Sarcoptic mange can be eradicated from a herd by adopting effective eradication measures before it gets a good start.

Sarcoptic Mange Mite

The mites that cause sarcoptic mange are small, whitish parasites (*Sarcoptes scabiei*, var. *suus*). The mature female is about one-fiftieth and the male about one-sixtieth of an inch in length. Although they are visible to the naked eye, particularly if placed on a dark background, it is advisable to use a

low-power magnifying glass in examining scrapings or material suspected of containing the mites. The body is round and the bluntly rounded head is as broad as it is long. When mature, this mite has four pairs of short, thick legs, the fourth pair and usually the third pair not extending beyond the margin of the body. A conspicuous feature under a high-power microscope is the presence of a number of short, backward-projecting spines on the upper surface of the body.

The entire life cycle is passed on the body of the host animal. The mites penetrate the upper layer of the skin and excavate burrows, or galleries, in which the eggs are laid. Each female may lay from 10 to 25 eggs during the egg-laying period, which probably lasts from 12 to 15 days, after which she dies in her burrow. The eggs hatch in from 3 to 10 days. The young mites, after passing through several molts, reach maturity and begin laying eggs in 10 or 12 days. As the surface of the skin constantly is wearing away and being renewed from below, the young mites are close to the surface when they hatch out. They escape from their shallow burrows and form new ones in which they, in turn, deposit eggs.

As the average period of incubation on the animal is 4 days and the average period after hatching until egg laying begins is 11 days, a new generation of mature mites may be produced about every 15 days.

Symptoms of Sarcoptic Mange

Sarcoptic mange of hogs may start on any part of the body. In the early stages, however, the lesions usually appear on the head, around the eyes, nose, or ears. From these it spreads to the hind legs, probably when the hog scratches the lesions with its hind feet. The lesions also spread backward over

the neck and shoulders and along the back and sides, finally involving the entire body.

In sarcoptic mange, nodules often form on the under side of the body, inside the hind legs, and around the shoulder pits and groins, especially during cold weather.

Ear lesions (fig. 3) are present in many mange-infested hogs, especially during warm weather. These lesions are usually similar in extent and severity to those on the rest of the body. The lesions on the inner surface of the ear are frequently about midway between the base and tip of the ear along the center line. They are often the only lesions with sufficient crusts to yield scabies mites readily on being scraped. Mites can usually be quickly demonstrated from these lesions on the inner surface of the ears because the scab mites are located rather superficially just under the crusts. The crusts here are more easily removed than those on other parts of the body. The location in the ear affords protection; hence ear lesions develop largely undisturbed.

The parasites penetrate the upper layer of skin, each mite forming a separate burrow, or gallery, in which it lives. On the quick, or sensitive, tissues the mites cause great irritation. The skin over and around each burrow becomes inflamed and swollen. The swollen areas are somewhat larger than pinheads and often a yellowish granule of dried serum adheres to them. As the mites multiply, the diseased area increases and the granular or raised areas run together. The hair over the affected part stands erect and some of it drops out or is rubbed off, though usually a few scattering hairs remain, even in advanced cases. The affected areas of skin often take on a dry, scurfy, or leatherlike appearance, especially when the mites are not very active. In the dry form of mange, the rubbing of the animal often has a



FIGURE 3.—Extensive mange lesions in the ears of a hog.

sort of polishing effect on the dead scales of the skin and the dried serum, giving the affected areas a dry, slightly glistening, silver-gray appearance.

The intense itching causes the animal to scratch and rub the affected parts until the skin becomes raw. The mechanical injury results in a running together of the small granular areas to form large scabs. The large scabs, which are firmly attached to the underlying skin, often are broken by the animal's movements and blood and serum ooze out of the cracks. The surface of the lesion may have a dry, pearl-gray appearance or it may be moist and stained a reddish yellow by blood and serum. In chronic cases the odor from the

moist form sometimes is very offensive.

As the disease advances the skin becomes bare, hard, thickened, and thrown into wrinkles, or folds (fig. 4). In severe cases the infested animals rapidly lose flesh and become very weak. Unless properly treated many die. Mites, which are thick in the furrows formed by the wrinkles, usually abound in scrapings taken from the bottom of a fold.

The most certain diagnosis of mange is the discovery of mites, which are the sole cause. This often is difficult, especially in the early stage of the disease, because of the parasites' burrowing habits. To find them, scrape the affected areas with a blunt-edged knife until the



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FIGURE 4.—A case of advanced hog mange showing wrinkled condition of skin.

blood flows and examine the scrapings, in the warm sunshine or near artificial heat, under a low-power magnifying glass. If in doubt, soak the scrapings in a 10-percent solution of caustic potash and examine them under a microscope.

Spread of Sarcoptic Mange

Sarcoptic mange of hogs is contagious. It is usually spread by direct contact with infested animals and is readily transmissible to man and to some other animals. The mites generally live only a limited time on a new animal host. The disease may persist in man for 30 days or longer and cause extreme annoyance. It is advisable to bathe and change clothing as soon as possible after handling mangy hogs.

As the sarcoptic mites live in their burrows, they do not spread to other animals so rapidly as the varieties that live solely on the surface of the skin. Owing to the hogs'

habit of sleeping in close contact with one another, however, the disease often makes great headway in herds confined in pens or stables. The infestation spreads rapidly in crowded or unclean quarters when hogs are exposed to cold or given insufficient feed or feed of poor quality, or in other circumstances that tend to lessen the vitality or functional activities of the animals. The spread of the disease is not limited to any one season, although healthy hogs become infested less often during the summer, especially if they have access to green succulent feed and are kept in open lots or fields where they are exposed to the sunshine.

Hogs of all classes, ages, and conditions are susceptible to sarcoptic mange, but usually the disease does not spread rapidly in well-fed, vigorous animals kept in sanitary quarters. The weak, unthrifty animals are the first to show lesions of the disease after exposure to the infesta-

tion and the mites spread from them to other hogs with which they come in contact. Visible lesions of mange may develop in from 14 to 45 days after exposure, or a much longer time may elapse. Cases of mange may become generalized in 6 weeks, or a much longer time may elapse before the lesions spread to any great extent.

One or more attacks of the disease do not confer immunity; after the disease has been cured the animals may become reinfested by contact with infested hogs or possibly by confinement in small inclosures in which mangy hogs have recently been kept. Although practically all cases of hog mange seem to originate from contact with infested animals, the possibility of infestation from infested premises should not be overlooked. The mite will not reproduce itself except on the bodies of animals, but it is able to live for 2 or 3 weeks when removed from hogs, and under favorable conditions may live much longer. Dislodged eggs which drop in moist, protected places may retain their viability for from 2 to 4 weeks during mild weather. In dry places, exposed to bright sunshine, the mites and eggs are destroyed in a few days.

Although hogs are not supposed to contract mange from infested premises, it is sometimes difficult to account for an infestation in any other way. It is advisable, therefore, to clean and disinfect all hog houses, pens, sheds, or small enclosures in which mangy hogs have been confined before using them for healthy hogs. Remove all litter and manure, cleaning down to a smooth surface; then spray all walls, woodwork, and floors with a good disinfectant. The coal-tar-creosote dips and disinfectants diluted in accordance with instructions on the containers are suitable for the purpose. Spread the manure or litter from

infested pens or buildings on the ground and plow it under or dispose of it in such manner that hogs cannot come in contact with it. Immerse or wash in the disinfectant all troughs and implements used in the infested inclosures.

Demodectic (Follicular) Mange

Demodectic (follicular) mange of hogs is caused by minute worm-like mites (*Demodex phylloides* [Csokor] and *Demodex folliculorum suis*). Similar follicle mites infest dogs, cattle, and other animals, as well as man. The parasites are truly microscopic in size, the full-grown female measuring approximately one one-hundredth of an inch in length. They penetrate the hair follicles and oil glands of the skin, where they complete their life cycle. When present in small numbers they apparently cause the animal no serious inconvenience, but occasionally they increase rapidly and cause well-marked lesions in the skin of the affected animal. The disease is contagious to hogs of all classes.

The lesions usually appear first on the snout or around the eyelids and spread slowly over the underside of the neck, breast, abdomen, inner sides of the hind legs, and other parts of the body where the skin is thin and tender. The back and upper parts of the sides where the skin is thick and tough usually are not affected. In the early stages of the disease the affected skin may be red and scurfy, and small, hard nodular lumps, ranging in size from that of a pinhead to that of a hazelnut, appear in the skin. The nodules may be dark red or they may be light red with a whitish or cream-colored center. As the disease advances the nodules break and discharge a creamlike pus or lumps of matter of a cheeselike consistency. Two or more of the nodules may

break and run together, forming suppurating cavities.

There is no known specific cure for demodectic mange, although frequent dippings in crude petroleum check its progress and heal many old lesions. Herds in which demodectic mange appears should be dipped in or treated with crude petroleum. Any animals having advanced cases which do not respond to treatment should be killed. The remainder of the herd should be fattened for market and disposed of and the premises cleaned and disinfected before being restocked with healthy hogs. The cleaning and disinfecting of premises is the same as for sarcoptic mange.

Treatment for Lice and Mange

Mange mites are more difficult to eradicate than hog lice. The mites burrow under the skin and lay eggs; hog lice live on the surface of the skin and attach their eggs to the hairs. Consequently, lice can be more easily reached with insecticides than mites. In general, whatever destroys mange mites will also destroy lice. However, measures taken to destroy lice may frequently fail to destroy mites.

A receiving pen, properly isolated and equipped, should be maintained for holding all incoming hogs so that they can be treated before being added to the herd. If a dipping vat is maintained, the pen at the entrance end of the vat may be used as a receiving pen or as a breeding pen for outside animals. Hogs that have entered the receiving pen should not be allowed to come in contact with or enter the herd until they have been dipped or otherwise properly treated.

The commonly used methods of applying treatment for external parasites of hogs are (1) hand applications, (2) spraying, (3) hog oilers, (4) medicated wallows, and

(5) dipping. Dipping is the best method.

If no dipping vats or wallows are available or if the weather is too cold for dipping or spraying, hand applications are beneficial in checking the spread of lice or mange. Treatment of hogs by dipping, by spraying, or in medicated wallows during the mild weather of autumn is good insurance against the risk of loss from mange and lice and the probable additional expense of winter treatment. In applying treatment for either mange or lice the entire herd should be treated whether all the animals show infestation or not. Sows heavy with pigs, however, should not be dipped within 2 weeks of their farrowing time or too soon after farrowing. When the pigs are about 3 weeks old the sow and pigs may be dipped without undue risk. All the pigs of the litter, however, should be dipped or treated in the same manner as the sow, to prevent failure of the sow to recognize any that are not dipped and her refusal to suckle them.

Hand Applications

Because of the difficulty of restraining hogs and of covering the entire surface of the body by hand applications, this method of treatment should be used only as a make-shift until the animals can be dipped or otherwise treated. The following remedies, when applied by hand, have proved effective for lice and mange: (1) Crude petroleum, (2) cottonseed oil and kerosene, equal parts, and (3) kerosene and lard mixed in the proportion of one-half pint kerosene to 1 pound of lard. These remedies may be applied with a brush, mop, or cloth and they should be distributed in a thin, even coating over the entire surface of the head and body, including the inner surfaces of the ears and between the thighs. When treatment

is being applied for mange special care should be taken to see that all spots of scab are well coated. Freshly oiled or greased hogs should not be moved rapidly, exposed to bright sunshine, or allowed to become chilled, as they are easily injured.

Crude petroleum is an effective remedy for lice and mange and on account of its spreading, adhesive, and protective qualities it is suitable for use in hand applications. It may be applied with a can having a flattened spout or from an ordinary sprinkling can having large holes in the sprinkler. The practice of throwing feed on the ground and sprinkling oil on the hogs while they are eating is not recommended, because some of the oil falls on the feed and is consumed by the animals. A better method is to restrain the hogs during the application of the oil by crowding them in small pens or enclosures. Applied by sprinkling or pouring, the oil usually does not reach the inner surface of the ears, which should be given supplementary treatment with a swab that has been dipped in the oil.

Hog Oilers

Hog oilers, or rubbing posts, are devices so arranged that when a hog rubs against them a small quantity of oil is deposited on or near the spot of skin being rubbed. The homemade rubbing post is set firmly in the ground and wrapped securely with a gunny sack or rope that is kept saturated with oil. The oil is poured over the post covering from time to time or a can of oil is fastened to the top of the post and the rope or gunny sack is kept saturated by fastening the upper end in the vessel of oil. Patented hog oilers of various types are on the market and many hog growers in the Corn Belt have one or more of them on their hog lots.

When a hog wants to rub itself it does not go to a rubbing post unless it happens to be close to one; it rubs against the first convenient object it finds. At best only a limited area of skin is covered with oil when a hog rubs against an oiler; consequently the various oiling devices are not successful in eradicating external parasites. When the oil containers are kept supplied with oil and the machine is not allowed to become clogged with mud, the use of hog oilers tends to lessen the spread of lice and mange, but they should not be depended upon to eradicate mange mites or lice or even to prevent the losses caused by gross infestations.

Medicated Hog Wallows

In applying treatments for external parasites, take advantage of the hog's instinctive habit of wallowing in water when the weather is warm. By medicating the water in well-constructed wallows (fig. 5), remedies for lice and mange can be applied satisfactorily with a minimum expenditure of money, time, and labor. For satisfactory results, however, the nature and habits of the animals to be treated must be considered.

Given a choice, hogs invariably select shallow water in which to wallow. When a hog wades into water it apparently tries to measure the depth and learn the nature of the bottom by submerging its nose and face. If the water is too deep, it may squat on its haunches or lie down, resting on its chest and abdomen with its legs folded under and its head elevated, but not on its side. If the water is so shallow that the nostrils can be kept above the surface of the liquid easily, the hog lies down on its side and rolls; then it gets up and repeats the performance on the other side until the entire surface of its body is wet. As a volume of liquid is displaced

when a hog lies down in the wallow the water line is raised accordingly. The greater the number of hogs lying in the wallow at one time the higher goes the water line. The right depth of liquid in the wallow, therefore, depends on the size and number of hogs using the wallow.

For pigs weighing from 40 to 80 pounds the wallow should be charged with liquid to a depth of about 3 inches. For hogs weighing from 80 to 150 pounds about 4 inches of liquid is sufficient. The depth may be increased to 5 or 6 inches for heavier hogs, but the medicated liquid in the wallow should never be so deep that the hogs are afraid to lie down and wallow in it. When only one wallow is available for a mixed lot of hogs of various sizes, from 3 to 4 inches of liquid will give better results than a greater depth. The water should always be shallow and no medicine added until the hogs have become well-accustomed to using the wallow. After the habit of using the wallow is well-fixed, which usually requires 3 or 4 days, the depth may be increased if necessary and the medicaments added.

The wallow should not be kept medicated continuously, as the medicament when applied too often is likely to cause irritation and the hogs may refuse to use the wallow after a few days. In from 24 to 48 hours after the liquid in the wallow has been medicated all hogs probably will be well-soaked. Then the wallow should be drained and cleaned and recharged with water only. Medicaments may be added every week or 10 days until the desired results are obtained.

Hogs will probably drink from the wallows unless the water is denatured by some distasteful substance. Because of their denaturing qualities, their tendency to spread over the surface of the body, and their effectiveness as a remedy for external parasites, crude petroleum

and the oils derived from crude petroleum are the most suitable dips for use in hog wallows. In using oil in wallows add about 1 pint for each pig and about 1 quart for each hog. Observe whether all the animals use the wallow and whether their bodies are well-coated with the oil. If all are not well-coated add more oil to the wallow.

The oil floating on the surface of the water limits or prevents evaporation and if the wallow is exposed to the direct rays of the sun during the hot summer months the water becomes heated to such a degree that the hogs will not lie in it. It is advisable, therefore, to construct a shade over the wallow or to add the oil in the evening. Oil added after sundown usually is carried out on the bodies of the hogs before noon of the next day.

Provide a shady, well-ventilated place for freshly oiled hogs. Drain and clean all wallows as often as necessary to keep them and the surroundings in good sanitary condition.

Dipping

Dipping—immersing animals in a medicated liquid that will kill parasites—is the most effective known method of applying treatment. Dipping plants are usually arranged so that the hogs enter one end of the vat filled with dip, swim through, and leave at the opposite end. During dipping, the liquid in the vat should be from 40 to 48 inches deep, which is sufficient to swim the tallest animal. Determine the quantity of dip necessary to complete the work and get materials to make that quantity before starting to prepare the dip. The average 100-pound hog will carry out and retain from 1 to 1½ pints of dipping solution; full-grown hogs will retain about 1 quart. The total estimated quantity of dip which the animals carry out and retain plus what is required to charge the vat

should equal the total quantity required to complete the work if none is lost by leakage or otherwise.

The capacity of the vat is usually calculated in the following manner: Multiply the average length in inches by the average width in inches, then the product by the depth in inches; this gives approximately the number of cubic inches of space to be filled with dip. Divide this by 231 (the number of cubic inches in a gallon); the result will be the approximate number of gallons of dip required to charge the vat. To obtain the average length, add the length at the bottom to the length at the top (that is, at the line to which the vat is to be filled), and divide the sum by 2. Obtain the average width in the same manner. The depth should be taken at the middle of the vat, and should be from the bottom to dip line only and not to the top of the vat. Likewise, in determining the length and width, measure only the space to be filled with liquid and not above that line. The capacities of any tanks that are used are obtained by a like process. Gages or rods should be prepared and marked to show the number of gallons at various depths in the vat and tanks.

After the vat is filled to the required depth with any of the dips except oil, mix the contents well by stirring to insure uniform strength and temperature throughout. A good method of stirring the dip is to take a pail or empty dip container in which a wire bail has been fastened, attach a rope or dipping fork to the bail, allow the vessel to fill and partially sink. Then drag it rapidly from one end of the vat to the other, repeating the operation several times.

Before beginning operations, examine the pens, chutes, slide board, vat, etc., for projecting nails, broken boards, or any object that may puncture or wound the hogs, as the

dip may injure those having fresh wounds. Water the hogs before bringing them to the vat so they will not be thirsty at the time of dipping. Handle them as carefully as possible. Pigs should be cut out and dipped separately from the full-grown hogs. To prevent piling up and drowning of hogs in the dip, provide a gate or other means of checking them and allowing them to pass only as there is room in the vat.

Men with dipping forks should be stationed along the vat to render assistance and to keep each animal's body submerged while it is swimming through the vat. The head of each animal should be completely submerged at least once before it leaves the vat. When the heads are ducked the air enclosed in the ears may keep the dip from wetting their inner surfaces or coming in contact with lice or mange in the lower folds. Make sure that the dip enters the ears of each animal as it passes through the vat. This may be accomplished by slowly pushing the head so low in the dip that the liquid flows into the ears from the under side while the air escapes at the top. Splashing the dip with a broom over and into the ears of the animals as they swim through the vat is also a satisfactory method. Dipping forks for handling the animals in the vat, keeping the body submerged, and ducking the head may be bought ready-made or may be made to order by a blacksmith (fig. 6; p. 19).

After the hogs leave the vat they should be held in draining pens or chutes until all surplus dip has drained off them. They should not be driven long distances or compelled to move rapidly within 24 hours or even longer after dipping, as injury may result from too much exercise or overheating shortly after dipping, especially if oil is used.

Do not dip hogs in dip that has been used and then allowed to stand

for a long time. Change the dip in the vat as soon as it becomes filthy, regardless of the number of animals that may have been dipped in it. In cleaning the vat, remove the entire contents, including sediment and foreign matter.

Effectiveness, effect on animals, cost of material and labor, and number of applications necessary for eradication are important considerations in selecting a dip for external parasites of the hog. The smaller the number of applications required for desired results, the greater the saving in time, labor, and money.

Scientific research during the last decade has resulted in the discovery, production, and marketing of several new insecticides known as the chlorinated hydrocarbons. They are now in common use on farms and ranches. Prior to 1940, the choice of an insecticide was rather limited. Several materials of plant origin, such as rotenone, pyrethrum, nicotine, pine tar, and pine oil, and some of mineral origin, such as sulfur, arsenical, and fluorine compounds, were available. For the control of external parasites of hogs, lime-sulfur and arsenical dips, the coal-tar derivatives such as creosote oils and naphthalene, and the petroleum derivatives such as crude oil and kerosene were recommended. The older dips are still being used, but they are being replaced by dips prepared from the chlorinated hydrocarbons.

Chlorinated Hydrocarbon Dips

The chlorinated hydrocarbon insecticides are not soluble in water and, therefore, are prepared as wettable powders or emulsifiable concentrates to make them usable with water. Some of these chemicals are capable of destroying the nits, or eggs, of hog lice and mange mites. Some also retain their insecticidal properties on the skin long enough

to kill new-hatched lice and mites. Because of this, a single dipping is sufficient to control and at times to eradicate these pests.

CAUTION: DDT and other chlorinated hydrocarbon insecticides, as well as rotenone, are poisonous to fish. When disposing of excess dips or sprays, do not let them flow into streams or ponds that are stocked with fish. Furthermore, do not let them collect in pools from which animals may drink. Neither should these mixtures be allowed to drain over vegetation on which livestock graze.

The chlorinated hydrocarbon insecticides most frequently used for the control of hog mange and hog lice are lindane, BHC, chlordane, and toxaphene. At present, treatment with chlordane and toxaphene is recommended only by spraying—not by dipping. There is as yet insufficient information on their effectiveness and safety to warrant their recommendation for use in dips. Lindane and BHC in their wettable forms are usually effective for the control of both mange and lice in a single treatment. A second treatment may at times be required after an interval of 10 to 14 days to effect complete eradication.

The principal insecticidally active ingredient in lindane and BHC is the gamma isomer. Lindane contains only the gamma isomer, while BHC is composed of five isomers, one of which is the gamma isomer. The wettable BHC contains 50 percent of inert ingredients and wetting agents. It may contain 6, 10, or 12 percent of the gamma isomer, depending on the company which formulates the product.

Wettable lindane contains 25 percent of the gamma isomer, the remaining 75 percent consisting of inert ingredients and wetting agents. The recommended concentration of gamma isomer for the

treatment of hog mange is 0.13 percent. This concentration can be obtained by adding $4\frac{1}{3}$ pounds of the wettable lindane-25 to each 100 gallons of water. To obtain the same concentration (0.13 percent) of the gamma isomer with the wettable BHC, use 18 pounds of the product that contains 6 percent gamma isomer, 10.8 pounds of the product that contains 10 percent gamma isomer, or 9 pounds of the product that contains 12 percent of the gamma isomer to each 100 gallons of water. The temperature of the water for dipping, even in cold weather, should not be above 80° Fahrenheit.

For control of hog lice, the recommended concentration of the gamma isomer is 0.06 percent, or approximately one-half of the amount recommended for hog mange.

A single treatment with wettable 50-percent DDT, at a concentration of 0.75 percent, is usually effective for the eradication of hog lice. A concentration of 0.75 percent can be obtained by adding 12.5 pounds of wettable 50-percent DDT to each 100 gallons of water in the vat. DDT is not recommended for the treatment of hog mange.

Chlorinated hydrocarbon insecticides are deposited in very small quantities in the tissues of animals treated with these chemicals. Some time is required for the natural elimination of the deposits. Therefore hogs should not be treated with any of the chlorinated hydrocarbon insecticides within 30 days of the time of slaughter.

Oil Dips

The most effective remedies for lice and mange of hogs are natural crude petroleum and some of the oils derived from crude oil. Unprocessed crude oil is an excellent dip for hogs, but it is difficult to obtain and costs more than some of

the processed oils. Processed crude oil from which gasoline and other light oils have been removed is commonly used and is effective in eradicating mange as well as lice. The thick residue left after the lubricating oils have been extracted is not suitable as a dip. Lubricating oil is also effective in eradicating lice and mange. Oils drained from crank cases of gasoline and other motors are commonly and successfully used for treating hogs. They are usually available and at low cost.

Distillate is sometimes added in small quantities to fuel oil to give a product that is sold at a high price as a special oil having a high degree of efficiency in eradicating mange and lice. The effectiveness of fuel oil against mange is increased by adding distillate or kerosene in the proportion of about 1 gallon to each 10 gallons of fuel oil. Heavy processed oils should be diluted with distillate until they flow freely from the container at the usual dipping temperature, but the quantity of distillate added should not exceed 20 percent. On the market also are several proprietary brands of crude-petroleum dip, consisting of processed crude oil to which other ingredients have been added. They usually are effective but cost more than the unmedicated crude oil.

In dipping hogs in crude-petroleum dip, fill the vat with water to within 6 or 8 inches of the dip line and then add the oil. The oil floats on the water, forming a layer from 6 to 8 inches deep, depending on the quantity added. As the hogs swim through the vat their bodies become coated with the oil. The oil dips are used cold, and one dipping usually is sufficient to eradicate lice or mange. When crude-oil dip is used it is not necessary to retard the progress of the animals through the vat, as their bodies become coated when they swim directly through.

Lime-Sulfur Dip

Lime-sulfur dip is effective in eradicating hog mange when four or more dippings are given with an interval of 6 or 7 days between. It is not effective against hog lice. In dipping hogs for mange the lime-sulfur dip should be used warm. The temperature of the dip while the animals are in it should be maintained at from 95° to 100° F. and visibly affected animals should be held in the dip 3 minutes.

Lime-sulfur dip is made in the proportion of 12 pounds of unslaked lime (or 16 pounds of commercial hydrated lime) and 24 pounds of flowers of sulfur to 100 gallons of water. Weigh the lime and sulfur and measure the water; do not trust to guesswork. Slake the lime in a shallow watertight box or tank and add enough water to form a thin paste. Sift the sulfur into the paste and mix well with a broad hoe until a mixture of about the consistency of mortar is formed, adding water as required. Put the mixture into 30 gallons of boiling water, adding slowly so as not to interrupt the boiling, and boil until the sulfur disappears from the surface. Continue the boiling from 1½ to 2 hours without stopping, stirring the mixture to prevent settling and caking on the bottom. When the sulfur has disappeared from the surface and the mixture is chocolate or dark-amber in color stop the boiling.

Draw off or dip out the contents of the boiling tank, place them in the settling tank, and let them stand until all solids have settled to the bottom and the liquid is clear. Some sort of settling tank provided with a bunghole is an absolute necessity, unless the boiler is so arranged that it may be used for both boiling and settling. An ordinary watertight barrel serves very well for a settling tank at a small vat.

A settling tank of any kind should have an outlet at least 4 inches from the bottom so that the clear liquid may be drawn off without becoming mixed with the sediment. Drawing off the liquid in this way has an advantage over dipping it out, for the reason that in dipping the liquid is stirred and mixed with the sediment. The prime object is to get the clear liquid without any sediment; any sediment in the dipping vat may injure the animals.

When the sediment has fully settled draw off the liquid into the dipping vat and add enough warm water to make a total of 100 gallons of dip. When mixed and cooked as specified, the concentrate is three and one-third times the strength required for the dip in the vat, so that to every 30 gallons of such concentrate 70 gallons of warm water should be added to make a dip of the required strength.

In preparing lime-sulfur dip in large quantities several hundred gallons of concentrate are often made at one time in a single large cooking tank. The quantity made at one boiling is limited only by the facilities at hand. If the boiling tank is big enough, enough dip to dip the herd should be cooked at one time. The quantity of mixture in the cooking tank may be varied, but not the proportions of the ingredients.

Many proprietary brands of lime-sulfur dip are equal to or even better than homemade dips. Ready-made dips should be diluted and used according to directions on the containers. Experiments by the Bureau of Animal Industry show that dry lime-sulfur scattered in the bedding will not eradicate sarcoptic mange of hogs.

Coal-Tar-Creosote Dips

The coal-tar-creosote dips when properly used in soft water are fairly effective in eradicating hog

lice if two or more dippings are given with an interval of 15 or 16 days between. This is necessary because the first dipping does not destroy the eggs. These dips have not proved dependable remedies for mange. They may be used cold or warm, but the temperature of the dip while the hogs are in it should not exceed 95° F.

These dips are sold under many trade names. The principal ingredient is creosote oil, which is made soluble in, or miscible with, water by means of soap. In the undiluted coal-tar-creosote dips, especially in cold weather, naphthalene and other constituents may separate out from the dip. Care should be taken, therefore, to see that the dip is homogeneous before any portion of it is used. These dips should be diluted in accordance with the directions on the containers.

Arsenical Dip

The arsenical dip as used for eradicating cattle ticks in the Southern States is an effective remedy for hog mange when four dippings are given with intervals of 6 or 7 days between. As crude-petroleum dip is much more economical and effective, arsenical dip for hogs is not recommended except when a farmer in the southern tick area has a few infected hogs that he can dip in a cattle vat.

Spraying

Power-driven sprayers of several types are available for the application of insecticides. Application with a power sprayer has some advantages over other methods of treatment. It is easier to move the equipment from place to place than to take hogs great distances to a dipping vat. Animals can be sprayed in a small pen without being caught and restrained individually, as is necessary in hand-

application operations. Power-spraying is more effective than use of insecticides in hog wallows or the various types of hog oilers.

The primary disadvantage of the spraying method is the possibility of not thoroughly wetting the hogs. A careless spraying job may leave areas of the body untouched with spray, especially the under surface of the neck, the belly, between the thighs, and in the ears. Animals constantly turn their faces away from the spray. Hence areas about the eyes, the muzzle, and inside the ears are frequently inadequately treated.

Some waste of insecticide is unavoidable when it is applied as a spray. All the runoff is wasted and rather large amounts are lost through misdirection and repeated spraying of the same hog or the same areas on an animal.

Hog mange and lice can be successfully treated with hand-operated equipment, such as barrel-type pumps and knapsack sprayers. Large herds can be more efficiently treated with equipment consisting of a pump developing from 100 to 200 pounds of pressure and delivering about 3 gallons a minute. The spray gun should be of a type that can eject the spray through a No. 5 disk, producing a cone pattern 4 to 6 inches across when held 2 feet from the animal. For spraying the under side, an effective job can be done with a 3-foot extension of a three-fourths-inch steel gas pipe attached to a spray gun having at the end two spray nozzles directed at a 45° angle.

Hogs should be treated in groups of not more than 5 to 10 at a time, confined in a pen measuring about 8 by 10 feet. They should not be too tightly packed; a certain amount of movement within the pen is desirable. Each animal must be able to move without crowding and piling up on another. Sufficient space must be provided so that

after one side of the animal has been sprayed it can be turned to expose the other side. A 100-pound hog can be adequately sprayed with one-half gallon of material; larger hogs may require up to 1 gallon or more. Small suckling and weanling pigs should be separated from the herd and dipped by hand in barrels or tanks containing enough spray to cover them momentarily. After treatment, keep the hogs under shelter or in the shade to retard evaporation of the spray. All animals in the herd must be sprayed, because one infested animal may reinfest the entire herd. Sows with litters should not be sprayed until the pigs are about 3 weeks old. Newly acquired boars should be sprayed before they are put into the herd for breeding.

The best practice in louse and mange treatment is to spray the herd in the late fall and again in the early spring, if needed. Select a warm, sunny day; sickness and losses may result from undue exposure.

Sprays

Oil sprays, such as lubricating oil, kerosene, petroleum, and coal-tar-cresote compounds, are rapidly being replaced by wettable chlorinated hydrocarbon insecticides, such as lindane, BHC, chlordane, toxaphene, DDT, and methoxychlor, and insecticides of plant origin, such as rotenone and pyrethrum.

Lindane is very effective against hog mange and hog lice. A somewhat higher concentration is required to kill mange mites than hog lice. For hog mange, use wettable lindane having a 25 percent gamma isomer content, at the rate of $4\frac{1}{3}$ pounds to 100 gallons of water. This concentration is calculated to contain 0.13 percent of the gamma isomer. For hog lice, use only half as much, or approximately 2

pounds to 100 gallons of water. Lindane is virtually odorless.

BHC, also very effective, can be obtained as a wettable powder having 6, 10, or 12 percent of gamma isomer. For hog mange, a concentration of 0.13 percent of the gamma isomer is recommended.

To make a spray with BHC having 6 percent of gamma isomer, add 18 pounds of the powder to each 100 gallons of water. With 10-percent gamma isomer powder, the proportion is 10.8 pounds of powder to 100 gallons of water; with 12-percent, 9 pounds.

For lice, one-half the quantity above specified in the same amount of water will be adequate. The musty odor of the BHC wettable powder is, of course, undesirable.

Chlordane and toxaphene are obtainable as 40-percent wettable powders. They will destroy lice and hog mange mites at an 0.50 percent concentration, obtained by adding 10 pounds of powder to each 100 gallons of water.

DDT is not recommended for hog mange. The application of a concentration of 0.75 percent, however, eradicates lice. This concentration is obtained by adding 12.5 pounds of wettable powder containing 50 percent DDT to 100 gallons of water. A second treatment, when needed, should be applied 12 to 14 days after the first treatment.

Rotenone-bearing powder, an insecticide of plant origin imported from the East Indies and South America, sold as cube, derris, or timbo powder, contains approximately 5 percent rotenone. It is not recommended for hog mange, but will destroy lice when used at the rate of 2.5 pounds to 100 gallons of water. It does not destroy the eggs and a second and sometimes even a third spraying is required at 12- to 14-day intervals.

Do not spray hogs with chlorinated hydrocarbon insecticides within 30 days of the time of slaughter.

Construction of Hog Wallows

The ground on which hog wallows are built should have good drainage and its surface should be graded so that there will be no depressions in which water can form pools. Hogs seem to like shallow pools and mudholes better than any other kind of wallow. Hence the wallow must be so placed and the pens so arranged that during treatment the hogs will have access to no wallows other than the one designed for the purpose.

A wallow in common use is made either of concrete (fig. 5) or of lumber, the concrete construction being more durable and in the long run more economical.

The length and breadth of the wallow may vary, depending on the owner's taste and the number of hogs kept. A wallow large enough to accommodate the entire herd at one time is advantageous, but not necessary because all the hogs seldom visit the wallow at the same time. A wallow of the style and size shown in figure 5 will easily accommodate a herd of 20 hogs of various ages.

The top of the side and end walls should extend at least 4 inches above the surface of the ground to keep surface water from running into the wallow. The entrance and exit incline should have a gradual, easy slope, so that the hogs may safely enter and leave the wallow. To prevent slipping, the concrete floor of the incline should be roughened with a broom soon after it is laid and grooves made in it with a bar, or bricks may be set on edge in the concrete to form cleats or toe-holds.

In the Northern States, where winters are cold, the side and end walls usually are extended into the ground below the frost line to prevent heaving and cracking of the concrete. A tar-filled joint is made where the floor joins the walls. The

walls and floors should be reinforced with heavy woven fence wire. Place the woven wire in the forms so that it will be embedded in the center of the walls. In building the floor and exit incline, lay the woven wire on top of a 3-inch layer of concrete and cover with a layer of equal thickness.

The system commonly used for draining hog wallows (fig. 5) has an overflow pipe which connects with a discharge pipe and acts as a plug when it is screwed into its threaded connection at the floor level. To drain the wallow, unscrew the overflow pipe at the floor level. The overflow pipe should be protected so that hogs cannot rub against it. This may be done by bolting two pieces of scantling across the corner. The bolts and pipe connections should be placed in position before the concrete is laid. The approach to the entrance end of the wallow should be paved with concrete or stone to prevent the formation of mudholes and to protect the ground supporting the floor of the incline.

The general instructions on excavations, forms, etc., for dipping vats are applicable to hog wallows and the concrete should be prepared and laid in the same manner.

Construction of Dipping Plants

Small herds of hogs such as are kept on the average farm may be dipped in a portable galvanized-iron hog vat (fig. 7), which can be purchased ready-made and answers the purpose very well. In setting the vat, make an excavation the dimensions of which slightly exceed the outside dimensions of the vat, except the depth, which should be less, so that when the vat is set in the trench the top may extend about 6 inches above the surface of the ground. Provide a crowding chute and a running chute ending in a slide board at the intake end of the

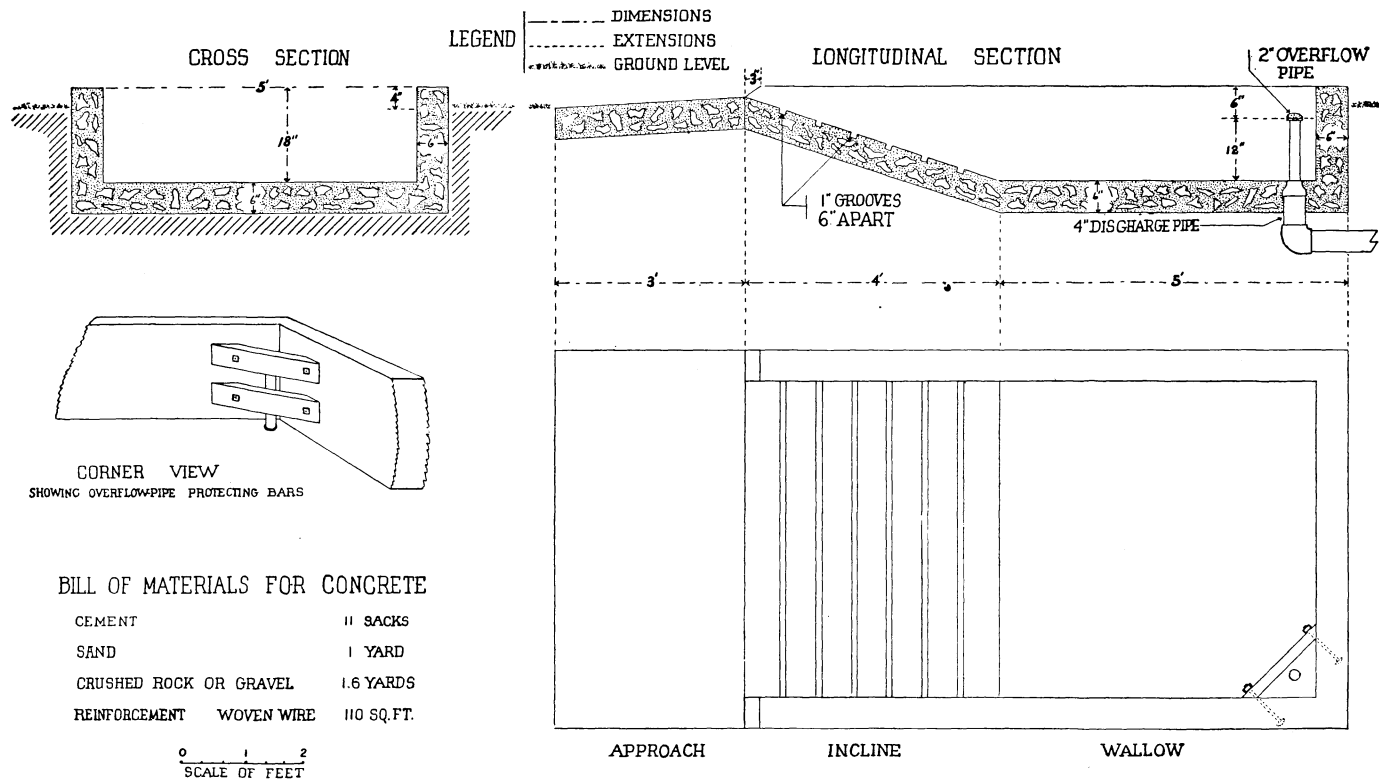


FIGURE 5.—Plan for hog wallow of concrete construction.

vat. A draining pen or chute should join the vat at the exit or sloping end.

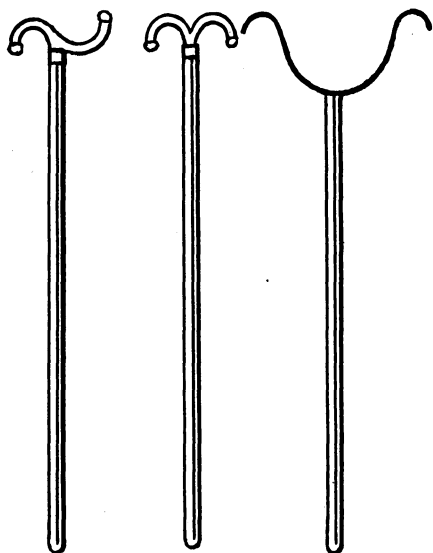


FIGURE 6.—Dipping forks.

On farms where large numbers of hogs are raised or fed, a permanent dipping plant (fig. 8) is more satisfactory and in the long run more economical.

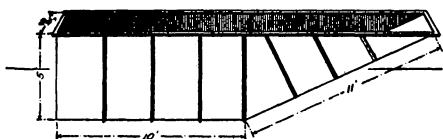


FIGURE 7.—Portable galvanized-iron dipping vat.

Selecting a Location

In selecting a location for a dipping plant keep in mind the fact that animals work better upgrade. The corrals and running chute should slope up to the entrance end of the vat. The vat should be on level ground, preferably extending north and south, with the entrance at the south and the exit at the north. Animals work better when not facing the sun. Because plenty of water is required, the dipping

plant should be close to an adequate supply. The vat, however, should not be built on low, marshy land or where floodwaters overflow.

Pens and Chutes

The receiving corral or pen into which hogs are driven preparatory to dipping should have an opening directly into the forcing or crowding chute. If the draining pen is not large enough to hold the entire herd, provide a holding pen for the freshly dipped hogs.

The running chute should be at least 20 feet long and, preferably, curved so that the approaching animals cannot see the vat. The width may vary from 18 to 22 inches, depending on the size of the animals, and the sides should be tight-boarded. The height of the chute should be about 40 inches, or high enough to keep the animals from jumping over the sides, but sufficiently low so that the men stationed along the sides to keep the animals moving may work over the top. Hogs work better in the chute if it slants upward to the slide board.

When hogs come out from the vat they carry some of the dip, which runs off their bodies very fast. Save this dip and return it to the vat. It may be used over and over again. Furthermore, if allowed to drip off in the holding corrals it will collect in pools to form highly objectionable mudholes and injure hogs that may drink from the pools. Draining pens should have watertight floors, sloping toward the vat or settling wells, to catch the drip and return it to the vat. The pens may be small or large according to the length of the vat. Their floors, of either lumber or concrete, should have settling wells (fig. 8) or water traps to keep rain from running into the vat to dilute the dip.

In constructing the draining pens of concrete it is advisable to build the outer walls in the same manner

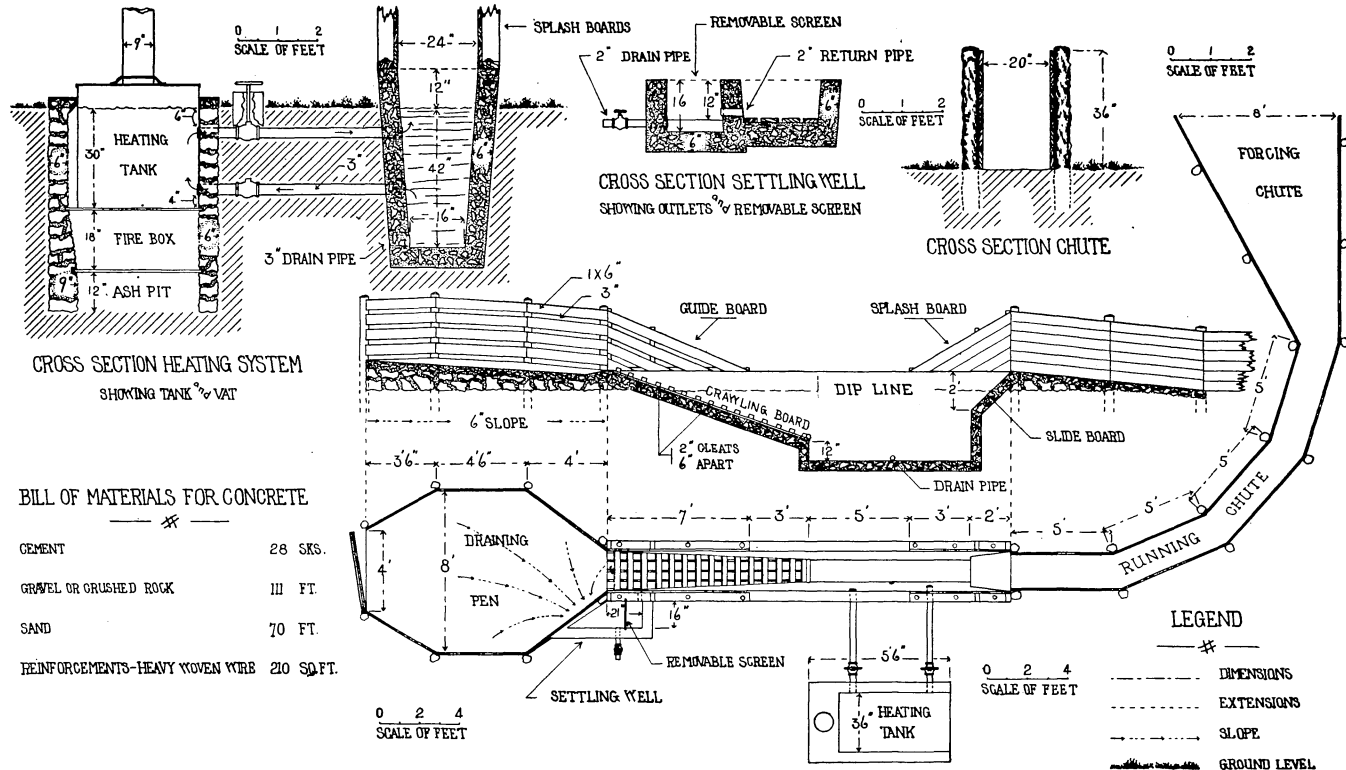


FIGURE 8.—Plan for hog-dipping vat of concrete.

as the foundations for a house, except that they are to be 6 inches thick. Fill the space inside the walls with gravel or other suitable materials to the required height and lay the sloping floors on the tamped gravel. To prevent slipping roughen the concrete floors with a stiff broom while the concrete is soft, or apply a coat of pebble dash. Wooden floors, if used, should be double, with a layer of tar paper between. Rough lumber may be used for the lower floor, but the top one should be of matched boards 1 inch thick. Cleats should be nailed on the floor to keep the hogs from slipping.

Dipping Vat

The dipping vat may be of either concrete or lumber. When properly made the concrete vat is more durable and in many other ways more satisfactory than one made of lumber. The sides may be perpendicular, but sloping sides are generally considered more desirable.

The length of the vat may range from 20 to 40 feet, depending on the number of hogs to be dipped. The top may extend from 9 to 18 inches above the surface of the ground, or may be flush with it, but the extended top affords better conditions for handling the hogs. In either style the ground should be graded up to provide a well-drained path along each side of the vat.

The bottom width of the vat with sloping sides may vary from 6 to 12 inches or even more. The slide board should be made of, or covered with, a smooth-surfaced material, such as planed lumber, sheet metal, or well-troweled concrete. In order that the exit incline, or crawling board, may not be too steep for hogs to climb up easily, the lower end usually is raised about 12 inches above the floor of the vat (fig. 8). A false floor made of lumber and

having cross cleats to prevent slipping may be bolted to the concrete floor of the exit incline, or bricks may be set on edge in the concrete.

Permanent pipes for conducting water and dip to the vat should be laid so as not to be in the way of the men working along the vat, but they should enter the vat above the dip line so that any leakage may be detected. There should be no obstructions in the paths along both sides of the vat; neither should there be over the top of the vat any crosspieces that might interfere with the proper handling of the hogs while they are in the dip.

If softwood is used, the frame timbers should by 6 by 6 inches; if hardwood, 4 by 4 inch timbers are sufficiently large for the purpose. Cedar posts make good framing timbers, as they do not rot rapidly. Matched planks, 2 inches thick, should be used in building the vat, and they should be beveled so that all joints and seams may be calked with oakum and rosin or similar material.

Concrete Vat

The trench for a concrete vat should be excavated so that the inside dimensions correspond to the outside dimensions of the completed vat. If reasonably firm, the sides of the trench may be used for the outer walls of the form, but whenever the vat is extended above the surface of the ground it is necessary to build forms extending from the ground surface to the top of the vat. If the soil is sandy, or the walls cave in, outer forms will be needed, in which case the trench should be wide enough for them.

The forms usually are made of 1-inch boards and 2- by 4-inch braces. As a supply of lumber usually is necessary for the corrals and chutes, some of it may be used for the forms and afterward for constructing corrals and chutes.

All bolts and the drain and other pipes should be placed in position in the forms before the concrete is laid. The concrete should be reinforced with heavy woven wire, and the reinforcements should be placed properly in the forms, so that they may be embedded in the middle of the walls.

The concrete for dipping vats should be made of 1 part of portland cement by measure, $2\frac{1}{2}$ parts of sand, and 4 parts of screened gravel or crushed stone. The sand should be coarse, clean, and free from foreign matter. The crushed stone or gravel may vary in size from $\frac{1}{4}$ to 1 inch in diameter. The mixing should be done on a smooth, tight platform and the sand and rock measured separately in a bottomless box 2 feet long, 2 feet wide, and 1 foot deep, having a capacity of 4 cubic feet. For the $2\frac{1}{2}$ cubic feet, mark the inside of the box $7\frac{1}{2}$ inches up from the bottom. Each sack of portland cement is considered to be equal to 1 cubic foot. Mix the sand and cement thoroughly, add the crushed stone (previously drenched with water), and mix the whole mass by turning it several times with shovels. Then add water in a depression made in the center of the pile and mix well by turning several times with shovels, adding enough water during the mixing to make a quaky, or thin, jellylike mixture.

Start placing the concrete in the forms as soon as the mixing is finished. Lay the floor and exit end first and tamp the concrete well. In filling the forms, settle the concrete into place by spading rather than by tamping; pay special attention to spading next to the inside forms to force the coarse particles back

and allow the sand-cement mortar to form a dense, watertight surface. An old hoe straightened out makes a good spading tool, as the handle is long enough to reach the bottom of the form. If it is necessary to stop work for the day before the forms are filled, roughen the surface of the concrete in the forms with a stick. Just before placing additional concrete wash the roughened surface and paint it with cement and water mixed to the consistency of thick cream. Leave the forms in place 2 or 3 days, if possible, and wet the concrete daily. After the forms are removed, dampen the surface of the concrete and apply a finishing coat composed of 1 part of cement and 2 parts of sand, or mix cement and water to the consistency of cream and apply it, brushing well to form a smooth surface.

Heating Facilities

Heating equipment for the dipping plant is not necessary when crude-petroleum dip is used, but homemade lime-sulfur dip requires facilities for cooking the dip and also for heating it in the vat. The cooking may be done in an open kettle or tank, having a fire box under it, or live steam may be piped in for boiling the dip.

The common system of heating the dip in the vat is to pipe live steam from a steam boiler directly into the liquid. The steam pipes usually are extended along the floor of the vat at least two-thirds the length, and are provided with openings for the escape of steam into the dip. When the open-tank heating system (fig. 8) is used, settling wells are not necessary, as the heating tank answers the purpose.